

Penile Length of Prepubertal Children in Surabaya

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Abstract

Background: Early recognition of phallic size abnormalities is essential to identify underlying endocrine and genetic disorders. Parents are concerned regarding their son's penis length, especially obese and short-stature boys. This study aimed to investigate the factors of penile length in prepubertal boys aged 9–11 in Surabaya.

Methods: A cross-sectional analytic observational study was conducted between October and November 2021 during the community services program of the Andrology Study Program, Universitas Airlangga. One hundred forty-eight healthy boys aged 9–11 years were enrolled in this study. Penile parameters and anthropometric measures were recorded. Data were analyzed with Spearman Rho's formula to correlate the variables studied.

Results: The average penile lengths and penile circumference of the penis were 6.3 ± 1.4 and 5.2 ± 1.0 cm, respectively. This study found two boys with micropenis (1.4%) with normal and overweight body mass index (BMI). The penile length was positively correlated with height but not with BMI.

Conclusion: Androgen and growth hormones significantly influence penile length. Children with abnormal BMI tend to have smaller penile sizes, associated with increasing androgen aromatization.

Keywords: Body mass index, micropenis, penile circumference, phallic size, short stature.

Althea Medical Journal.
2023;10(3):144–148

Received: December 7, 2022
Accepted: May 11, 2023
Published: September 30, 2023

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Introduction

Early recognition of phallic size abnormalities may be helpful for an early diagnosis of an underlying endocrine or genetic disorder.¹ Several genetic syndromes and hypothalamic-pituitary-gonadal (HPG) axis hormonal deficiencies are associated with micropenis. An abnormal phallic anatomy in which the penis looks smaller than expected should be managed correctly.^{2,3} Penile problems are usually determined using a penile parameter, including stretched penile length and penile circumference.⁴ Several studies revealed that stretched penile length gradually increases with age, rapidly increasing at around 13

years.^{1,4–7} Micropenis is a medical diagnosis based on accurate length measurement, which occurs only in XY males.⁸ It refers to a small penis with a penis length of less than 2.5 SD below the mean value for its age without other structural abnormalities of the penis, such as hypospadias.^{2,8}

Sexual differentiation begins intrauterine. The HPG axis is activated in the 15th week of gestation. A peak androgen level occurs at 14–16 weeks of fetal life and 1–3 months after birth. Penile length markedly increases during the second and third trimesters, with a 20 mm increase from week 16 to 38.^{8,9} Hence, it can be deduced that micropenis is caused by hormonal abnormality after

the first trimester of pregnancy.⁹ The most common cause of hormonal disturbances were hypogonadotropic hypogonadism, androgen receptor insensitivity, testosterone, 5-alpha-reductase, and growth hormone deficiency.¹⁰

Sometimes, the parents bring the obese child to a physician due to their concern regarding a small penis. Penis size is usually average because of excess fat around the pubic area, which conceals the penis.¹¹ Lack of knowledge about the age-related penile size and precise measurement was the cause of the concern. Therefore, an accurate measure of penile length can differentiate micropenis from such cases. Moreover, a misdiagnosis of micropenis may delay treatment and cause parental anxiety. Most concerns over penile length are based on penile belief in inappropriate, stereotypical body image, and average penis for future genital satisfaction.^{12,13}

According to the Ministry of Health of the Republic of Indonesia, about 18.8% Indonesian children are overweight, and 10.8% are obese.¹⁴ A previous study has reported an increased incidence of micropenis in children with abnormal body mass index (BMI), showing that 23 out of 94 children in the prepubertal group (24.45%) have a micropenis.¹⁵ The negative side of micropenis in children is that it does not significantly impact everyday life. However, when ignored, genital anomalies may lead to psychosocial dysfunction and anxiety in adult life.¹³ Micropenis in children can be treated using hormonal therapy. Exogenous administration of testosterone to prepubertal boys significantly increases penile length.^{3,8}

Published evidence suggests that the link between penile length and anthropometric measures in prepubertal children differs. Further research is needed to assess the relationship between BMI and penile length. This study aimed to investigate the factors of penile length in prepubertal boys aged 9–11 in Surabaya.

This study is significant for further investigations to attain precise and conclusive results for physicians to address parental queries regarding body composition and penile length in the prepubertal boy.

Methods

A cross-sectional analytic observational study was conducted from October to November 2021 during the community services program from the Andrology Study Program Universitas Airlangga. All children aged 9–11 among students in Elementary Schools in

Surabaya were enrolled in this study. Children with penile abnormalities (buried penis, concealed penis, trapped penis, webbed penis, hypospadias, micropenis, and chordee) were excluded. Parental permission was requested to allow children's participation in this study.

Penile parameters (stretch of the penile length and penile circumference) were measured using plastic tape. Stretch penile length was calculated from the pubo-penile junction (ramus pubis) of the penis to the tip of the glans on the dorsal surface. The suprapubic fat was pushed to the bone, fully stretched with the maximal extension of the penis but in a still flaccid state using a wooden spatula vertically along the dorsal penis. The penile circumference was measured in the middle of the shaft.⁵ Measurements were performed three times and a mean value was calculated.

All participants underwent a physical examination. Age, height, weight, and waist circumference were collected to allow for statistical analysis. BMI was calculated by using the formula of weight (kg)/[height (m²)]. Penile parameters were compared and analyzed according to BMI. BMI was classified according to the terms of the Ministry of Health of the Republic of Indonesia. Penile length was classified using a mean table, and stretched penile length was calculated based on the standard deviation (SD) in Asia.⁸

The protocol of this study was reviewed and approved by the Health Research Ethics Committee, Faculty of Medicine, Universitas Airlangga (approval number: 46/EC/KEPK/FKUA/2022).

All statistical analyses were computed using statistical software SPSS version 26.0 for Windows (IBM Corp. Armonk, NY, USA). Results were presented as mean±SD for quantitative variables. Penile dimensions were not normally distributed after the Kolmogorov-Smirnov test. Correlation analyses were performed using Spearman Rho's formula. A p-value less than 0.05 was considered statistically significant.

Results

During the study period, 148 schoolboys aged 9–11 were examined for penile parameters, BMI, and waist circumference. The average age was 10.5±0.6 years, with predominantly 11 years. Mean weight, height, and BMI were 40.6±12.0 kg, 142.9±8.4 cm, and 10.5±0.6 kg/m², respectively (Table 1).

The mean stretched penile lengths and penile circumference of the penis were 6.3±

Table 1 Characteristics of Participants

Characteristics	n	Mean±SD	Min	Max
Age (years)	148	10.5±0.6	9	11
Weight (kg)	148	40.6±12.0	20.50	79
Height (cm)	148	142.9±8.4	125	171
BMI (kg/m ²)	148	10.5±0.6	12.1	31.2
Penile length (cm)	148	6.3±1.4	3	12
Penile circumference (cm)	148	5.2±1.0	2.5	9
Waist circumference (cm)	147	71.5±12.6	48	98

Table 2 Penile Parameters based on Age Group

Age	n	-2SD of Penile Length (cm)	Penile Length (cm)	-2 SD of Penile Circumference (cm)	Penile Circumference (cm)
9	5	6.4 ± 1.0	4.4	5.6±0.8	3.0
10	68	6.1 ± 1.4	3.3	4.9±1.0	2.9
11	75	6.3 ± 1.4	3.5	5.4±0.9	3.6

1.4 and 5.2±1.0 cm, while the mean waist circumference was 71.5±12.6 cm (Table 1). The penile length and penile circumference according to age group showed that the penile length was longer than penile circumference for each age group (Table 2).

There was no significant correlation between BMI and penile length (Table 3). Besides, negative correlations of the two variables showed that the more significant BMI, the smaller the penis length. The strength of the correlation was very weak since it was below 0.2. Furthermore, the correlation between penile length and height, which was positively and significantly correlated (Table 4).

Our data showed two boys with a micropenis (1.4%). The BMI of the boys with

micropenis was normal and overweight, respectively. Besides, we found 14 cases of boys with a small penis (9.5%); 9 with a small penis have obese BMI (64%), 3 with normal BMI (22%), 1 with underweight (7%), and 1 with overweight (7%) (Table 5).

Discussion

Previous studies have investigated the correlation between penile dimension and somatometric parameters; however, the findings remained questionable. The most recent report on penis size is collected among Caucasians (Europeans, South Asians, and North Africans), while studies in Mongoloids (East Asians, especially South East Asians) are limited.^{16,17} The methodology to draw

Table 3 Spearman's Rho Correlations of Body Mass Index and Penile Length

Variable	Correlation Coefficient (r)	p	n
Body mass index	1.000	-	148
Penile length	- 0.073	0.381	148

Note: significant if p<0.05

Table 4 Spearman's Rho Correlations of Penile Length and Height

Variable	Correlation Coefficient (r)	p	n
Penile length	1.000	-	148
Height	0.175	0.034	148

Note: significant if p<0.05

Table 5 Penile Length

BMI Classification	Penile Length Classification		
	Micropenis (n, %)	Normal (n, %)	Small Penis (n, %)
Underweight	0 (0)	5 (4)	1 (7)
Normal	1 (50)	83 (62)	3 (22)
Overweight	1 (50)	14 (11)	1 (7)
Obese	0 (0)	30 (23)	9 (64)
Total	2	132	14

conclusive values on penile length differed among studies. It was challenging to have a precise range of measurements to adequately manage micropenis, small penis anxiety, or body dysmorphic disorders that counseling could treat. Hence, the result of this present study could be helpful in clinical practice and educational purposes regarding penile dimensions.

Penis grows during pregnancy and male body development until the end of puberty. It is regulated under the androgen and hormonal activity of the hypothalamic-pituitary axis.¹⁸ Therefore, the majority of micropenis cases are caused by hormonal defects. Normal variations of penile length must be appreciated since studies that list the growth curve of penile size are not uncommon; however, the normal range for these studies has been described in terms of mean±SD.¹⁹ Our data showed a consistent normative median stretch of the penile length and penile circumference in prepubertal age of 6.3 and 5.2 cm. Previous reports demonstrated much more uniformity of penile length and girth. Our data are consistent with earlier information regarding mean penile length around 5 cm and mean penile circumference at 5.52 cm until ten years. Penile length increases simultaneously with penile girth.¹⁹

In this study, we used BMI measurements as a variable to evaluate the relationship between BMI and penile length. BMI has been widely used to determine nutritional status and to measure of adiposity in clinical setting. We found an insignificant relationship between penile length and BMI. However, 14 subjects in this study had a small penis, and 64% with obese BMI. In contrast, a study from Vietnam shows a minor correlation between penile dimension and BMI (with Spearman rho <0.2).²⁰

Obese children tend to have less testosterone, which may lead to a disorder of penile development. The onset, duration, and progression of puberty are mainly affected by testosterone action. Increased

peripheral conversion of testosterone to estradiol and increased inflammation due to increased adipose tissue may explain the pathophysiologic mechanism of metabolic disorders that may lead to suppressing the HPG axis and delay secondary sexual maturation in adolescent males.²¹

Leptin dysregulation in obesity decreases GnRH function and its pulsatility, impacting the HPG axis in response, which suggests another mechanism for hypogonadism in obese children. There should be an optimal level of leptin signaling to the brain to allow GnRH pulse to stimulate gonadotropin hormone for optimal FSH and LH secretion.²²

In conclusion, the mean penile length and circumference values in prepubertal Surabaya boys are determined in this study. Penile length and BMI appear to have no correlation. However, a negative trend exists between BMI and penile length in pre-puberty children aged between 9–11 in Surabaya. Prepubertal obesity may link to decrease penile length in puberty, which shows smaller penile length. Abnormal BMI can contribute to penile length abnormality in prepubertal boys. This study also reveals micropenis occurs in children with normal and overweight BMI. A standardized procedure for measuring penile size should be applied since temperature may affect penile dimension. In addition, other factors such ethnicity and genetics play an essential role in micropenis cases because micropenis can be inherited genetically. Our data has found a correlation between penile length and height though we have a small sample size compared to other studies on penile length reference.^{23,24} Various ethnic groups and locations are needed in further research to ensure accurate study results. Additional research on the factors influencing puberty is required for further evaluation and public health implications.

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